LISTING OF CLAIMS

This listing of claims will replace all prior listings of claims in the application:

1-28. (Cancelled)

29. (New) A process for treating the surfaces of flowable solid parts, comprising the steps of:

providing a tublike vibrator device having therein a generally horizontally-elongated treating channel which is of narrow width and which extends angularly about a center point;

providing a flowable mass of solid elements with at least a quantity of said elements comprising individual flowable solid parts;

supplying said flowable mass into said channel so that the mass, over a length of the channel, fills the channel to a significant depth which is less than the maximum channel depth;

vibrating the tublike device to cause the mass of solid elements, when supplied to the channel, to flow lengthwise of the channel while undergoing a corkscrew-like motion wherein the elements undergo a gentle rotatable tumbling movement through numerous closely-adjacent transverse convolutions with the forward advance per convolution as the mass slowly moves lengthwise along the channel being less than the width of the channel;

providing a spray arrangement positioned adjacent the channel so that a discharge orifice thereof is positioned closely adjacent and above the flowing mass and is oriented generally downwardly toward the flowing mass as it advances slowly along the channel with said corkscrew-like motion;

discharging from said orifice an abrasive spray comprising a high-velocity fluid carrier having small abrasive particles entrained therein and directed generally downwardly into the flowing mass to define a concentrated spray zone which contacts a small concentrated surface area of the upper

surface of the flowing mass and which penetrates a substantial distance downwardly into the flowing mass to effect treating of multiple surfaces of the parts as they slowly tumble during their passage through the spray zone during the corkscrew-like movement of the flowing mass, the abrasive spray contacting the surface area of the flowing mass over a majority of the width of the channel and over a lengthwise extent which equals or slightly exceeds the lengthwise forward advance defined by adjacent transverse convolutions of the flowing mass; and

continuing the corkscrew-like motion of the flowing mass downstream away from the spray zone.

30. (New) A process according to Claim 29, including positioning the discharge orifice of said spray arrangement substantially at or within a mouth of said channel and spaced upwardly above the flowing mass so that the discharged abrasive spray is confined within the channel and is allowed to diverge sidewardly so that the spray zone, where it contacts the flowing mass, extends across a substantial part of the channel width and extends lengthwise of the channel by a similar amount; and

maintaining the abrasive which is sprayed into the mass within the flowing mass for further abrasive contact with the parts as the flowing mass moves lengthwise of the channel away from the spray zone.

31. (New) A process according to Claim 30, wherein the channel is defined by bottom and side walls which are joined by rounded corners so that a bottom portion of the channel has a generally rounded configuration and the channel has a relatively narrow width so that the vibration of the tublike device causes the flowing mass to undergo said numerous closely adjacent convolutions as the mass is advanced lengthwise along the channel so that substantially all of the parts are effectively moved upwardly into and through the spray zone during the corkscrew-like movement of the mass.

32. (New) A process according to Claim 31, wherein the parts are of a delicate or frangible material and/or have a complex three-dimensional configuration.

33. (New) A process according to Claim 29, including the steps of:

providing a second spray arrangement positioned adjacent the channel at a location which is disposed in spaced relationship from the first-mentioned spray arrangement and which is disposed downstream thereof relative to the lengthwise direction of movement of the flowing mass along the channel; and

discharging from an orifice associated with said second spray arrangement a surface treating stream which is directed generally downwardly into the flowing mass to define a concentrated spray region which covers a significant part of the width of the upper surface of the flowing mass and which penetrates a substantial distance downwardly into the flowing mass to effect surface treating of the parts as they slowly rotatably tumble during their passage through the spray region during the corkscrew-like movement of the flowing mass, said spray region being located downstream of and spaced from the spray zone defined by said first-mentioned spray arrangement, and the treating stream discharged from said second spray arrangement being different from the abrasive spray discharged from said first-mentioned spray arrangement so as to effect a different surface treatment of the parts as they move through the spray region.

34. (New) A process according to Claim 29, including providing the treating channel of the tublike vibrator device with first and second generally annular channel parts which effectively surround one another and are in lengthwise communication with one another to define a path for the flowing mass.

35. (New) A process according to Claim 29, wherein the channel has a rounded concave bottom wall, a width in the range of from about four inches to about eight inches, and an arcuate configuration extending through an angle of at least about 360°.

36. (New) A process according to Claim 29, wherein the discharging of the abrasive spray into the flowing mass within the channel causes the spray zone where it contacts and penetrates into the mass to extend over a contact distance in the lengthwise direction of the channel which is in the range from about one to about one and one-half times the forward advance defined by the convolutions of the flowing mass so that substantially all parts within the flowing mass move into and through the spray zone during a single passage of the flowing mass along the channel.

37. (New) A process according to Claim 29, wherein the horizontally elongate channel has a generally spiral configuration as it extends from the inlet location to the outlet location, and the outlet location is disposed on the spiral radially outwardly of the inlet location.

38. (New) A process according to Claim 29, including the step of discharging a second abrasive spray into the flowing mass within the channel at a location spaced downstream from said first-mentioned abrasive spray with said second abrasive spray being defined by high-velocity air containing entrained abrasive particles to define a second spray zone which penetrates into the flowing mass to effect abrading of the parts as they move through the second spray zone.

39. (New) A process according to Claim 38, wherein the abrasive particles discharged into the flowing mass at said

second spray zone have physical properties which are different from the abrasive particles discharged into said mass at said first-mentioned spray zone to permit different surface treating of the parts as they sequentially move through the first-mentioned and second spray zones.

40. (New) A process according to Claim 39, wherein each of the first-mentioned and second abrasive sprays are discharged at locations disposed closely adjacent but above the flowing mass so as to be discharged downwardly onto and into the flowing mass as it moves lengthwise along the channel.

41. (New) A process according to Claim 40, including effecting separating of a significant quantity of said abrasive particles as supplied at said first-mentioned spray zone from said mass and discharging said separated abrasive particles from said channel at a location which is disposed downstream of said first-mentioned spray zone but upstream of said second spray zone.

42. (New) A process for abrading flowable bulk parts, comprising:

providing a vibratory treating device defining therein a horizontally elongated, upwardly opening treating channel having a width which is small relative to the channel length;

supplying a flowable bulk mass containing a large quantity of bulk parts into said channel at a supply location so as to fill the channel to a depth less than the maximum channel depth;

providing said flowing bulk mass with bulk insert tumbling elements mixed with said bulk parts to provide for carrying and spacing of the bulk parts as they are tumbled along the channel, the inert tumbling elements having a shape which is different from the shape of the bulk parts;

vibrating the treating device so that the bulk mass flows lengthwise of the channel while undergoing a gentle continuous movement along a generally helical flow path which extends lengthwise of the channel away from the supply location and has numerous closely-adjacent transverse convolutions so that the individual bulk parts are gently rotatably tumbled in a generally transverse circular path and are simultaneously advanced lengthwise of the channel;

providing a first discharge nozzle having a discharge orifice positioned closely adjacent and above and downwardly directed toward the helically flowing mass within the interior of said treating channel at a location between said supply location and a discharge location for said parts;

discharging from the orifice of said discharge nozzle a downwardly directed abrasive spray defined by high-velocity air containing entrained abrasive particles to define a first spray zone which penetrates into the helically flowing mass over a substantial width and depth thereof and which contacts the helically flowing mass over a lengthwise extent which at least equals the forward advance per convolution thereof to effect abrading of the parts as they move through the spray zone due to the gentle rotatable tumbling of the parts transversely of the channel and the simultaneous lengthwise advancement thereof;

providing a second discharge nozzle having a discharge opening position closely adjacent and above and directed downwardly toward the helically flowing mass within the interior of said treating channel at a location which is spaced downstream from said first discharge nozzle in a direction of flow of the flowing mass along the channel;

discharging from the orifice of said second discharge nozzle into the continuous tumbling mass an abrasive spray defined by a high-velocity carrier fluid having entrained abrasive particles to define a second spray zone which penetrates into said helically flowing mass downstream from said first spray zone to effect further treating of the parts

as they move through the second spray zone due to the vibratory helical tumbling movement thereof, the abrasive spray discharged from said second discharge nozzle having physical properties which are different from the abrasive spray discharged from said first discharge nozzle;

the helical vibratory movement of the tumbling bulk mass along the channel causing and allowing the orientation of the individual bulk parts within the helically flowing mass to constantly change as the parts slowly move through the first and second spray zones so that different surfaces and edges of the parts are subjected to the high-velocity abrasive sprays which, in combination with the gentle tumbling contact of the parts with one another, effect surface treating of the parts;

discharging the flowable bulk mass from the treating channel at said discharge location which is disposed downstream from said second spray zone; and

continuing the vibration of the treating device to continue the gentle helical flow of the bulk mass from the supply location into, through and then downstream away from the first spray zone and thence into, through and downstream away from said second spray zone and thence downstream for discharge of the bulk mass at said discharge location so that the bulk mass is subjected to a first-in first-out treating operation.

43. (New) A process according to Claim 42, including the steps of:

maintaining the abrasive which is sprayed into the flowing mass at said first spray zone within the flowing mass for further abrasive contact with the bulk parts as the flowing mass moves lengthwise of the channel downstream away from said first spray zone.

44. (New) A process according to Claim 43, including effecting separation of a significant quantity of said abrasive particles as supplied at said first spray zone from

the flowing mass and discharging said separated abrasive particles from said channel at a location which is disposed downstream of said first spray zone but upstream of said second spray zone.

45. (New) A process according to Claim 42, wherein the air as discharged by said first discharge nozzle has a discharge velocity in the range of between about 80 feet per second and about 150 feet per second.

46. (New) A process according to Claim 42, wherein the treating channel has first and second generally annular channel parts which surround one another and which provide communication from a downstream end of one channel part into an upstream end of the other channel part so that the flowing bulk mass can move continuously along the length of the channel from the supply location to the discharge location.